

Marine Voyage Data Recorders

International Symposium on Transportation Recorders

May 3-5, 1999

Submitted By:

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KEYWORDS

Marine, IMO, IEC, ISM, Port-State, VDR

INTRODUCTION

“Data recorders” in some form have been around for quite some time in the marine industry. They include, but are not limited to, log books, navigation charts, bell or engine order logs, course recorders, hull stress meters, propulsion and auxiliary engine computer logs, vessel traffic service (VTS) systems, Rescue Coordination Center (RCC) radio transmission tapes, and the Automatic Identification System¹ (AIS). A marine voyage data recorder (VDR) centralizes the various measurements taken on board a vessel in one “protective” place from which data can be retrieved at a later date for analysis. Many companies have already taken the initiative of installing VDRs not only to obtain data in the event of an accident or incident, but also to assist in managing their fleets.

In an October 10, 1998, article, *Boxing Clever*, Lloyds List writes,

Ironically, of all the technical requirements that are designed to prevent accidents (although most are designed to minimize their consequences), the provision of ‘black boxes’ is something that only comes into its own after the incident. Not that there is no commercial reason (value) for their adoption on ferries. Voyage event recorders can monitor whatever is required, from the way a ship is handled, to the performance of the machinery, and its forensic employment must be considered almost incidental. They have proved themselves in operation in a number of areas, from the optimization of fuel economy measures to the defense of the owner in the event of an incident. And although it can be argued that they scarcely affect safety directly, the lessons they produce certainly do.

This paper will review the history of VDRs, specifically their promotion by the NTSB, the International Maritime Organization’s (IMO’s) actions and its pending carriage requirements, the International Safety Management (ISM) code requirements, IEC performance standards, the position of the classifications societies on VDRs, the VDR and Port State control, VDRs in international investigations, and operational management requirements of the ship owner.

¹ AIS gathers vessel movement information and assembles it into an AIS-compliant data sentence. Incoming vessel information, including GPS/DGPS, heading, course over the ground, and speed, is displayed on a device, such as a personal computer or laptop. A vessel provides its identification (official number), position, course, heading, speed, and receives information on other vessels, port data, and hazards in area.

MAIN SECTION

MARINE DATA RECORDERS - A HISTORY:

Promotion by the NTSB

The National Transportation Safety Board (NTSB) has promoted the use of event recorders on ships since the 1970s. Drawing on its extensive experience with aviation and surface vehicle data recorders, the Safety Board has worked with the U.S. Coast Guard, other agencies, and marine industry companies in rulemaking efforts and development of technical standards for VDRs. The NTSB supports the use of these systems not only as accident investigation tools, but also as management tools. The following is a brief summary of marine accidents investigated by the NTSB in which it identified the need for VDRs and issued safety recommendations related to developing or requiring the systems.

The NTSB identified the potential use of VDRs in accident reconstruction in its investigation of the collision between the SS *C.V. Sea Witch* and the SS *Esso Brussels* and resulting fire in New York Harbor on June 2, 1973.² Based on its findings in the accident, the NTSB made the following safety recommendation to the Coast Guard:

Require the installation of an automatic recording device to preserve vital navigational information aboard oceangoing tankships and containerships. (M-76-8)

Following its investigation of the collision of the U.S. tankship SS *Marine Floridian* with the Benjamin Harrison Memorial Bridge in 1977,³ the NTSB made the following safety recommendation to the Coast Guard:

Conduct a formal study in coordination with the Federal Maritime Administration and the shipping industry to determine a standard array of operational and audio data that should be recorded automatically with a view to establishing a requirement for the installation and operation of suitable equipment in U.S. vessels over 1,600 gross tons built after 1965, and to submitting an initiative to the Inter-governmental Maritime Consultative Organization (IMCO)⁴ for the adoption of a similar international requirement. (M-78-2)

As a result of its 1981 special study, *Major Marine Collisions and Effects of Preventive Recommendations*,⁵ the NTSB made the following safety recommendation to the Coast Guard:

² Marine Accident Report - SS *C.V. Sea Witch* – SS *Esso Brussels Collision and Fire, New York Harbor, June 2, 1973* (NTSB/MAR-75/06).

³ Marine Accident Report - *U.S. Tankship SS Marine Floridian Collision with Benjamin Harrison Memorial Bridge, Hopewell, Virginia, February 24, 1977* (NTSB/MAR-78/01).

⁴ Now known as the International Maritime Organization (IMO).

⁵ MSS-81-1

Expedite the study to require the installation of automatic recording devices to preserve vital navigational information aboard applicable ships. (M-81-84)

The NTSB ultimately classified the three recommendations cited above “Closed—Unacceptable Action,” based on responses contained in a May 1982 letter from the Coast Guard, which stated:

The Coast Guard generally supports the concept of shipboard voyage recorders as an aid in casualty analysis. Recently, the U.S. Maritime Administration canceled their voyage recorder project and IMCO removed voyage recorders from their work schedule. In view of this and the severe funding limitations within the Department of Transportation, the Coast Guard does not plan to actively pursue a voyage recorder project at this time.

In 1995, the NTSB again identified the need for VDRs during its investigation of the collision between the Netherlands Antilles passenger *ship Noordam* and the Maltese bulk carrier *Mount Ymitos*.⁶ Based on its findings, the NTSB made the following safety recommendations to the Coast Guard:

Require all vessels over 1,600 gross tons operating in U.S. waters to be equipped with voyage event recorders. (M-95-5)

Propose to the IMO that it require all vessels over 500 gross tons to be equipped with voyage event recorders. (M-95-6)

Based on comments in a December 1, 1995, Coast Guard letter concerning VDRs, the NTSB replied that because the Coast Guard was not taking the “unilateral action as requested,” Safety Recommendation M-95-5 had been classified “Closed—Unacceptable Action” on February 6, 1996. The Coast Guard sent a follow-on letter dated September 23, 1996, concerning Safety Recommendation M-95-6, in which it stated:

We concur with the intent of this recommendation. We will work with the international maritime community and at the IMO to develop specifications for voyage event recorders. The carriage of a ‘black box’ is currently being discussed. However, there is presently insufficient support among member governments at IMO to establish international requirements for voyage event recorders, and to unilaterally establish requirements for vessels in U.S. waters would be detrimental to our efforts at IMO. We will keep the Board advised of our progress on this issue.

On March 20, 1997, the NTSB wrote:

Because the Coast Guard will work with the international maritime community and at the IMO to develop specifications for voyage event recorders and their carriage as

⁶ Marine Accident Report - *Collision of the Netherlands Antilles Passenger Ship Noordam and the Maltese Bulk Carrier Mount Ymitos in the Gulf of Mexico, November 6, 1993* (NTSB/MAR-95/01)

requested, Safety Recommendation M-95-6 has been classified “Open—Acceptable Response.” The Safety Board [NTSB] would appreciate periodic updates on the progress of this issue.

The Noordam accident also resulted in the NTSB asking the marine industry to promote the use of VDRs. The NTSB made the following safety recommendation to the International Council of Cruise Lines (ICCL):⁷

Propose to members that all passenger vessels over 1,600 gross tons operating from U.S. ports be equipped with voyage event recorders. (M-95-8)

Upon receiving notification from the ILLC that it supported the NTSB’s position on VDRs and that it had distributed copies of the safety recommendations to its constituency for their information and consideration, the NTSB classified Safety Recommendation M-95-8 “Closed—Acceptable Action” on December 12, 1995.

The NTSB made the following recommendation to Holland America Line Westours, Inc., as a result of the Noordam accident:

Review the management oversight program and implement measures to ensure that company watchstanding policies are followed on all ships. (M-95-10)

In an August 8, 1995, letter, Holland America advised the NTSB that, along with other management and oversight measures, it was evaluating a VDR system that had been installed on its passenger vessel *Statendam*, and that, if the system was satisfactory, Holland America would install such a system on all its other vessels. In response to Holland America’s action, the NTSB classified Safety Recommendation M-95-10 “Closed—Acceptable Action” on October 17, 1995.

Actions by the IMO

In 1996, in response to proposals by the United States and the United Kingdom, the IMO’s Navigation Subcommittee (NAV) requested that the International Electro-technical Commission (IEC) develop an international technical testing standard for VDRs based on IMO recommendations. On March 19-21, 1997, the IEC working group (TC-80/WG-11) began work on the performance standard recommended by the IMO’s NAV 43; the group issued its draft standard on March 19, 1999.

At the Design and Engineering Subcommittee (DE), the United States encouraged the IEC and the International Safety Organization (ISO) to cooperate in developing VDR standards. This should be re-emphasized because aspects of VDRs, such as carriage requirements and protection of the equipment, may extend beyond the purely electrical issues of VDRs.

IMO Resolution A.861(20), *Standards for Shipborne VDRs*

⁷ The ICCL is a major cruise ship operator association that represents some 19 cruise lines. Each year, its overnight cruise vessel operators carry more than 4 million U.S. passengers on 87 ships.

IMO resolution A.861(20) recommends VDR performance standards that, much like the standards for aircraft data recorders, are based on maintaining a record of data for accident analysis. Resolution A.861(20) observes that an IMO resolution adopted in May 1994⁸ had concluded that fitting ships, particularly passenger vessels, with VDRs is desirable to assist in investigations into casualties and had called on the IMO Maritime Safety Committee to develop standards for VDRs. Observing that SOLAS may make VDR carriage mandatory, IMO resolution A.861(20) invites governments to encourage shipowners and ship operators to install VDRs on their vessels as soon as possible. The resolution discusses including VDR carriage requirements in the revision of SOLAS chapter V (Safety of Navigation), which is expected to become effective in 2002.

The performance standards proposed in IMO resolution A.861(20) apply to either float-free or fixed models of VDRs and include the general provision that the purpose of a VDR is to maintain a storage, in a secure and retrievable form, of information concerning the vessel's position, movement, physical status, and command and control for the period leading up to and following an incident. The information would be for use by the Administration and the shipowner during any subsequent investigation into the causes of an incident.

The proposed performance standards require that the VDR continuously maintain sequential records of preselected data items relating to equipment status and output and of the ship's command and control. The VDR must be installed in a brightly colored protective capsule that is fitted with a device to aid in locating it. The VDR must operate automatically and record data for at least 12 hours. If the ship owner so wishes, the recorded information may be downloaded so long as the download does not interfere with the data recording function. This feature makes the installation and use of the VDR quite appealing to a ship owner as a management tool.

The complete VDR system, as defined by IMO resolution A.861(20)/4.1, must include all items required to interface with data input sources, all items necessary to process and encode data, the recording medium in its capsule, the power supply, and the dedicated reserve power source. The VDR, at a minimum, will record:

Date, time, ship's position, speed, heading, bridge audio, communications audio (radio), radar data, post-display data, echo sounder, main alarms, rudder order and response, hull openings (doors) status, watertight and fire door status, accelerations, hull stresses, wind speed, and wind direction.

IMO Carriage Requirements

The 44th session of the IMO Sub-Committee on Safety of Navigation, held in July 1998, considered VDR carriage requirements and made proposals, which appear as draft regulation 22 to SOLAS Chapter V. The proposed options include a provision limiting the new requirement for VDRs to Ro-Ro⁹ passenger ships on international voyages. Other options, which were submitted

⁸ IMO Resolution 12.

⁹ Roll-on roll-off vessels (Ro-Ro) that are designed with large bow or stem ramps (or both) to allow trailers or cars to

by the United Kingdom and supported by the European community, the United States, Canada, Australia, and New Zealand, require that all new vessels built by a certain date have a VDR and that all existing vessels install a VDR during a phase-in period, which will be at a later date. The United States proposed a requirement that VDRs be tested annually for operability by an independent inspection authority, much like the requirement for annual liferaft examinations. The United States observed that, with the proper equipment, the VDR test could be conducted on the vessel, and upon satisfactory completion of the exam, a certificate could be issued, which would show Port State authorities that the vessel is in conformance with regulation.

Some countries opposed the VDR requirement for “all” vessels. Japan and others stated that the carriage requirement should apply only to vessels on “international voyages;” Panama maintained that the VDR should only be required on “self-propelled” vessels. The IMO Sub-Committee hopefully will conclude its work on VDRs (and Chapter V) at its 45th session, and will require VDR carriage for all vessels over 3,000 gross tons, with a specified phase-in period for existing vessels.

IEC Performance Standards

In 1998, technical experts from around the world, including equipment manufacturing representatives and government accident investigators such as NTSB representatives, met at the British Standards Institute (BSI) in London to develop VDR functional performance requirements based on the generic performance standards approved by IMO in November 1997 (IMO Resolution A.861.) The IEC TC-80, WG-11 is tasked with developing these functional performance requirements, which, when published, will be known as IEC 61996 *Shipborne Voyage Data Recorder (VDR), Performance Requirements, Methods of Test and Required Test Results*. The “enquiry for vote” was submitted to the IEC members for review and solicitation of comments on March 19, 1999. The closing date for voting is August 31, 1999.

Classification Societies and the VDR

In recent discussions with representatives of the International Association of Classification Societies (IACS) and Lloyds Register of Shipping (Lloyds), this author asked about the position of the classification societies on the issue of VDRs. On February 2, 1999, Mr. James D. Bell, IACS Permanent Secretary, stated:

So far, there are no IACS policies or resolutions on VDRs at this stage. Of course, if/when something definitive does emerge it will be a statutory requirement rather than class associated and we will be involved as authorized agents for the Administrations. This does not mean that our members have not individually been involved in national and regional developments of such equipment.

In response to a July 13, 1998, email, a Lloyds representative responded to questions regarding discounts or preferences being offered to shipowners who have VDRs installed, stating:

be driven rather than lifted on and off the vessel.

There is no truth to this [rumor] that Lloyds or other societies were offering any discounts if a VDR is fitted. A class society will make a small charge for the approval of the installation and subsequent periodic surveys. The benefit comes from the shipowner being able to demonstrate that he is applying due diligence through a notation in the register book which specifies his ship has a VDR installed.

Lloyds subsequently issued *Provisional Rules for the Classification of Ship Event Analysis Systems* in 1998.

ISM Code Certification¹⁰

According to the chairman of the IACS, the greatest contribution to improved maritime safety can only come from higher conformance by the world fleet to recognized IMO Conventions and international safety standards. The *International Management Code for the Safe Operation of Ships and for Pollution Prevention* (ISM Code), adopted by the IMO in November 1993, is therefore a vital instrument to bring the improvements expected by the international community.

In a recent article, *Safe Today Is No Guarantee For Tomorrow*,¹¹ Det Norske Veritas's (DNV) Dr. Tor-Christian Mathiesen writes, "We are facing greater expectations of safe operation and pollution prevention. The answer is not the introduction of more rules and regulations. The challenge is to ensure compliance with all the rules and regulations that we have today." Tor-Christian Mathiesen believes that shipping's most important development in the past 10-12 years has been the focus on the human element. He states, "The human element is involved in all accidents. If you analyze accidents you will find the human element somewhere in the chain of events leading to them. Man is accountable for 100 percent of all accidents, not the 80 percent frequently quoted."

Dr. Mathiesen considers the ISM Code the most important modern safety instrument to the shipping industry, stating, "I am sure that the ISM Code has been on the agenda of the Board of all shipping companies operating internationally....if we succeed with proper implementation of the ISM Code, which we have to, we will see the development of a safety culture in shipping."

The IMO developed the ISM Code because it recognized that effective company management was paramount to ensuring marine safety guidelines and environmental protection. The ISM Code became a requirement for all vessels, except bulk carriers, in July 1998. As its full title implies, the objective of the ISM Code is to encourage companies to develop and maintain a safety-management system, which accomplishes the following general measures:

- Provides for safe practices in ship operation and safe working environment;
- Establishes safeguards against all identified risks; and

¹⁰ DNV FORUM ISSUE No. 3, 1996, article.

¹¹ DNV FORUM ISSUE No. 1, 1998, *Dr Tor-Christian Mathiesen, Chairman of The Council of IACS*:

- Improves the safety management skills of shoreside and shipboard personnel.

The ISM Code provides specific guidelines to companies for developing an effective safety-management system. For example, the ISM Code indicates that a company's safety-management system should include the following functional requirements:

- A safety and environmental protection policy;
- Instructions and procedures for ensuring safe vessel operation and environmental protection in compliance with relevant international and domestic law;
- Defined levels of authority and lines of communication between and among shipboard and shoreside personnel;
- Procedures for reporting accidents and non-conformities;
- Emergency preparedness and response procedures; and,
- Internal audit and management review procedures.

The ISM Code recommends that companies designate a shoreside person (or persons) having direct access to the highest level of management to be authorized and responsible for monitoring the safety and pollution aspects of each ship in the company's fleet and to make sure that adequate resources and shore-based support are applied "as needed." In addition, the ISM Code states that the company should clearly define and document the following areas of responsibility for each ship's master:

- Implementing the safety and environmental-protection policy of the company;
- Motivating the crew in the observation of that policy;
- Issuing appropriate orders and instructions in a clear and simple manner;
- Verifying that specified requirements, such as marine regulations, operational directives, and so forth, are observed; and
- Reviewing the safety-management system and reporting its deficiencies to shore-based management.

Under procedures established by the IMO, companies that demonstrate compliance with the ISM Code will be issued a *Document of Compliance*. Vessels owned and/or operated by these companies will be issued a *Safety Management Certificate* to be displayed on board the vessel. While the development of the ISM Code was developed primarily for deep-draft ships engaged in international commerce, the provisions of the Code are general and may be applied to all sectors of the maritime industry, including inland and coastal barge and towing operations. An example of an

inland program is the American Waterway Operators' *Responsible Carrier Program*.

The central objectives of the ISM Code are improved and consistent compliance through stronger enforcement of international rules and regulations. The ISM Code is widely regarded as the most important single development in maritime safety for many years. Introduced in two stages, the ISM Code will ultimately apply to 90 percent of the world's fleet, with 8,000 shipowning and operating companies. Phase One required the auditing of some 18,700 ships before 1 July 1998. Phase 2 will require another 20,700 ships to be audited before 1 July 2002.

Dr. Mathiesen observes, "A most important part of the [ISM] Code is the requirement to record incidents, analyze, and try to identify the basic cause in order to prevent recurrences." He describes Phase One of the ISM Code as "an important step" towards an industry safety culture. "By safety culture," he explains, "I mean a culture of saying, 'I can always improve,' which will enhance safety and pollution prevention.

Companies Employing VDRs to fulfill "ISM Responsibilities"

A survey by this author found that a number of operators view VDR systems as valuable tools to achieve the objectives of the ISM Code. P & O Lines, which is considered a pioneer in the development and use of VDRs, has been using VDR systems for years to fulfill its ISM responsibility to provide management oversight of its fleet. A P & O subsidiary, Three Quays International (Broadgate), reports that it has 120 VDR units throughout its fleets of Ro-Ro ferries, bulkers, tankships, and other vessels. VDR systems have been voluntarily installed on BP tankships, Conoco tankships, Chevron tankships, and Holland America Line passenger ships. In addition, the U.S. Navy has an experimental project with a system called "Smart Ship," which, among other functions, records radar data. Reportedly this system is being tested on the USS *Harry S. Truman* and the USS *Yorktown*.

Companies are finding that, in addition to the obvious ISM and postaccident value of VDR information, they can realize a payback in their fleet operations by using the data to monitor the various systems on board. In an 1998 article written for DNV FORUM ISSUE No. 2, *Performance Monitoring Enhances Operational Efficiency*, Stuart Brewer endorses the benefits of maintaining vital machinery data in order to review main engine performance data and to make adjustments as needed. Mr. Brewer's article states:

¹² DNV FORUM ISSUE No. 1, 1998, *Dr Tor-Christian Mathiesen, Chairman of The Council of IACS:*

There are several benefits in maintaining performance (records) of the main engine. As an example: modern two-stroke slow-speed engines are fitted with variable injection timing equipment (VIT). Correct functioning of the VIT is essential for good engine performance and by monitoring performance as laid down in the DNV program we can detect maladjustment's and make the necessary corrections. A correctly adjusted engine ensures better fuel economy, more operating hours per cylinder, and better overall engine condition and economy. It also results in cleaner exhaust gases and reduced harmful emissions. ...we see performance monitoring as a means to optimize the engine's condition and its maintenance intervals.

Based on the results from its "New Machinery Project" and in line with the procedures from its pilot test ship program, the DNV is planning to launch a new, voluntary class notation.

When the DNV was asked if it saw any use for such a new notation, a representative replied that such a notation would be much like a "stamp for good housekeeping," conveying to the market that from this ship you could expect reliable performance, good fuel economy and fewer unexpected costs in machinery maintenance.

In its first review of maritime safety,¹³ the European Transport Safety Council (ETSC) estimates that 140 fatalities occur annually in European sea transport and observes that the safety culture and safety regulations must be improved. The ETSC review identifies priority measures for accident reduction. Among these measures are a systems approach to safety and the need for better statistical information, specifically an European Union (EU) database and VDRs, and an independent maritime accident investigation agency. Other needs or changes that the ETSC review identifies include the following: a common education and training framework, international medical/psychological standards, a legal maximum blood alcohol level, fatigue reduction measures, on-board facilities, improved communications technologies, safety guidelines in and near ports, bulk carrier and ro-ro ferry design, survival capability of high speed craft, and passenger ferry survivability.

1 VDRs in Port State Control – Compliance

In a 1997 article¹⁴ for *IMO News*, the senior deputy director of the IMO's Maritime Safety Division states:

Port State control - the inspection of foreign flag vessels visiting national ports - has been described as the last safety net in marine safety. In an ideal world, Port State control would not exist, but when shipowners, classification societies, insurers or Flag administrations have in one way or another failed to do their job, Port State control comes onto the scene. Port State control is recognized as being a step in the right direction towards the eradication of substandard ships, when it

¹³ Copies are available from the ETSC, Rue du Cornet 34, B-1040 Brussels, Belgium.

¹⁴ *Port State control: An Update*, Fernando Plaza, Senior Deputy Director, Maritime Safety Division, IMO, IMO NEWS, Number 4, 1997.

is carried out in accordance with IMO Assembly resolutions and recommendations.

It is only natural that government agencies and their delegated inspectors¹⁵ employ the information gathered by the VDR in conducting the various Port State requirements, which includes enforcing the ISM Code and ensuring that a vessel is in compliance with U.S. navigation safety regulations (33 CFR 164) and applicable pollution prevention regulations (IMO/MARPOL¹⁶, and 33 CFR 151 to 159). The Coast Guard guidance in NVIC 4-98, states:

The objectives of SOLAS IX and the ISM Code are to ensure safety at sea, to prevent the occurrence of human injury or loss of life, and avoid environmental and property damage. Specifically, the ISM Code seeks to address the issues of human error and human omissions. To accomplish its objectives, the ISM Code requires owners of ships, or other organizations such as the managers, or bareboat charterers, who have assumed responsibility for ship operations, to implement Safety Management Systems for their companies and ships.

2 VDRs in International Investigations

On November 27, 1997, the IMO adopted IMO Resolution A.849(20), *Code for the Investigation of Marine Casualties and Accidents*, which the U.S. Coast Guard endorsed and disseminated in *Navigation and Vessel Inspection Circular Number: 5-98*. In issuing NVIC 5-98, the Coast Guard summarized the IMO action as follows:

The international community has increasingly become aware of the benefits of cooperating in casualty investigations given the international nature of shipping and the fact that Flag-State interests often overlap port-state interests. As a result, a series of IMO resolutions have addressed international cooperation in increasing depth, and many valuable cooperative investigations have resulted in the past 10 years. Drawing on the experience of these cooperative investigations, and recognizing the opportunity to improve safety through information sharing, the IMO member states developed a Code for the investigation of marine casualties and incidents. The Code provides a standard international approach to investigations and enhances the existing cooperative frameworks.

The Code includes an appendix, *Guidelines to assist investigators in the implementation of the Code*, which provides the following guidance on VDRs:

Where information from a VDR is available, in the event that the State conducting the investigation into a casualty or serious incident does not have appropriate facilities for readout of the VDR, it should seek and use the facilities of another State, giving consideration to the following:

¹⁵ Through its Streamline Inspection Program with small passenger vessels and its Alternate Compliance Program (see 46 CFR 8, *Vessel Inspection Alternatives*), the U.S. Coast Guard now authorizes the American Bureau of Shipping to perform inspections and certification on behalf of the Coast Guard.

¹⁶ International Convention for the Prevention of Pollution from Ships 1973, MARPOL

- .1 the capabilities of the readout facility;
- .2 the timeliness of the availability of the facility; and
- .3 the location of the readout facility.

CONCLUSIONS

VDR Safety Issues

The installation of VDRs is an important safety issue for all marine operators, especially for operators of passenger vessels. Automatic data recording devices provide crucial factual information for accident investigation and play a key role in identifying and addressing causal factors. While it can be argued that the VDR may not be a first line safety tool, such as a life jacket or fire extinguisher, it certainly has great value in ensuring that a vessel is operated safely, that its gear is performing as intended, and that the crews are performing as required by regulation, company policy, and the general rules of “good seamanship.”

VDR as a Management Tool

The VDR provides the vessel operator and owner with information that can be used to better manage the vessels operation, thus providing key information that can be used to improve traffic routing, manage hull stress conditions, and better manage fuel consumption. The VDR also provides the owner/operator with a comprehensive record of what occurred in an event, thereby assisting in the event of some tort action. The management benefits derived from installing a VDR system would quickly offset the cost of its installation.

ACKNOWLEDGEMENTS

Members of the IEC TC-80, Working Group 11
Mr. Chris Young, U.S. Coast Guard
Mr. Graham Marshall, Lloyds USA
Mr. Henry Chen, Ocean Marine Systems, Inc.
Mr. Byron Dawe, Rutter Technologies, Inc.
Mr. Todd Ripley, U.S. Maritime Administration
Ms. Patricia A. Barnes, NTSB writer/editor

3 Author’s Bio

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Mr. Brown is a 1975 graduate of the Massachusetts Maritime Academy, earning a BS in Marine Transportation. He earned an MS in Management from Lesley College in 1986. He has sailed on various classes of merchant vessels and holds a U.S. Coast Guard license: Master 1600 G.T., Oceans; Master 4000 G.T., Inland, Third Mate Any Gross Tons, Oceans. He received a direct commission in the U.S. Coast Guard in 1977, and has served in various marine safety

assignments. Now a Commander, U.S. Coast Guard Reserve, he is presently augmenting the Chief, Vessel Compliance Division at Coast Guard Headquarters. He joined the NTSB in 1991 as a Marine Transportation Safety Specialist. Mr. Brown participated with the U.S. delegation to IMO's NAV-44 and is presently a member of the IEC TC-80, WG-11 working on the development of the VDR performance standard.

